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FAO PLANT PROTECTION BULLETIN

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A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

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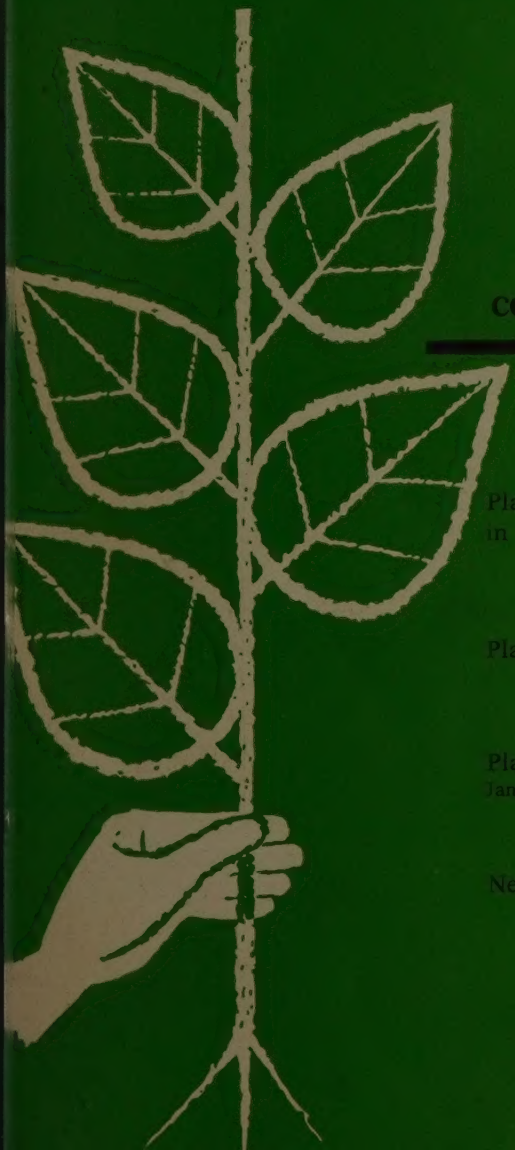

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FAO PLANT PROTECTION BULLETIN

is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Plant Pests and Diseases of Economic Importance in the Paraná Delta, Argentina[1]

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The Paraná Delta covers the southern part of the province of Entre Ríos and the northeastern part of the province of Buenos Aires, consisting of a great number of islands circumscribed by the Uruguay and Paraná rivers and their small tributaries (Figure 1). It occupies approximately 550,000 hectares. The land, which is of recent alluvial origin, is very flat, liable to floods, and composed of large overflowed areas covered with reeds. The islands, characterized by raised edges, have the appearance of flat washbowls.

The soil is usually composed of three fairly distinct horizons: the first with high organic matter content, the second consisting of silt and clay, and the third, which is waterlogged most of the year, contains a marl sand, sometimes with ferruginous concretions. The soil is for the most part acid.

The level of the water table varies according to the season but on the average it is at a depth of 30 to 60 centimeters on the lowlands and 80 to 140 centimeters on the edges of islands. Due to the high level of the water table and the repeated inundations, the amount of available water is nearly always high.

The weather on the Delta is mild both in summer and winter. The average temperature is 23° to 24° C. in January, the hottest month, and 10° to 11° C. in July, the coldest month, the mean annual temperature being 16° to 17° C. There is an average of eight to ten days of frost per year. Annual rainfall averages 900 to 1,000 millimeters and air humidity is always very high.

Fruit culture and silviculture are the main sources of revenue in the Delta area. Many important fruits are grown, and forests produce exclusively soft wood such as willow, poplar, and to a lesser extent, pine and other species. Basket willow is grown on small holdings.

In the lower Delta, fruit culture, mainly apple, quince, pear, peach, prune and citrus, is more important but there are also tree plantations, some producing only timber and others fruit and timber. In the upper Delta, silviculture is predominant but lemon, orange, mandarine and grapefruit are also cultivated. In addition, New Zealand hemp (*Phormium tenax*) thrives very well in the islands, and vegetables, such as cauliflower, squash, chili and cabbage, are grown on a small scale.

With the exception of prunes, which grow well on lower lands, fruits are grown on the edges of the islands or on high land formed by deposits as a result of the dredging of rivers and streams or the opening of canals.

Climatic conditions are conducive to the development of pests and diseases, and plant protection is one of the important problems confronting the grower.

Pests of fruits

Although no new pests have been recorded on fruit trees in recent years, fluctuations in

[1] This report was compiled by the laboratories of agricultural zoology and plant pathology of the Estación Experimental del Delta, Instituto Nacional de Tecnología Agropecuaria, Campana, Province of Buenos Aires.

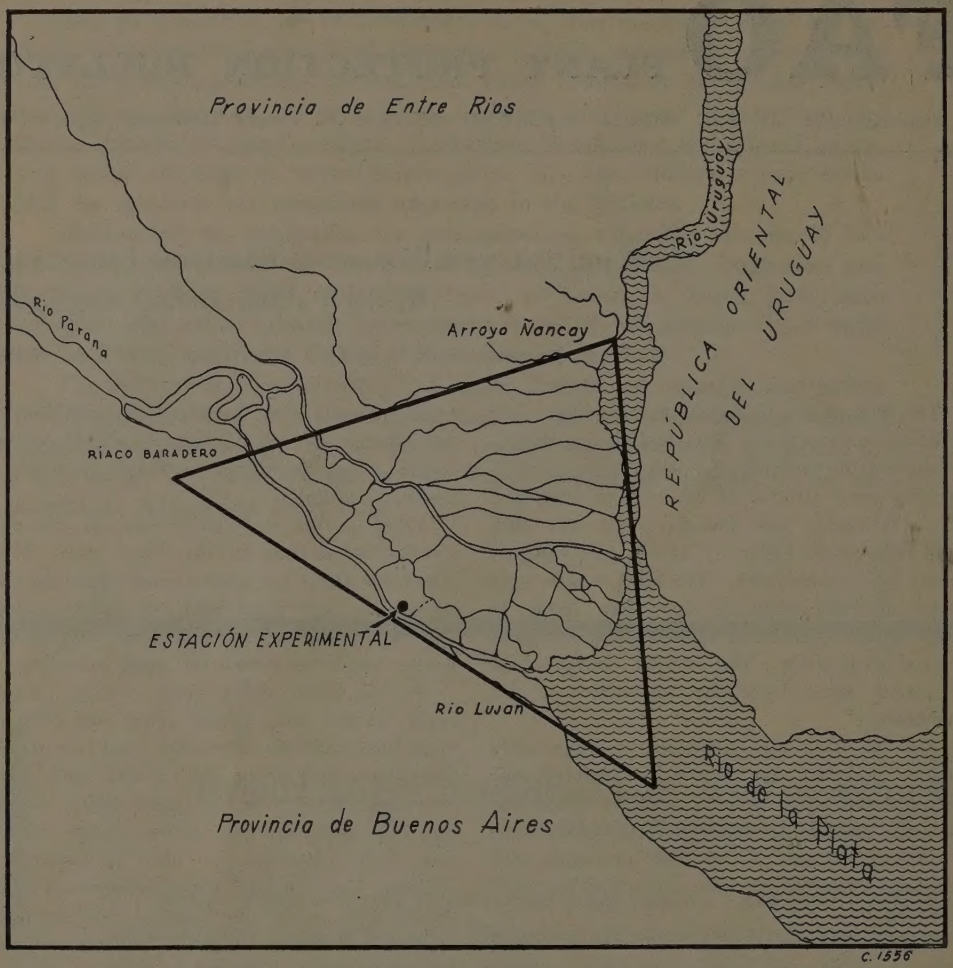

Figure 1. Map of the Paraná Delta.

distribution and incidence of existing species have been observed in different zones. A fair example is the delta scale, *Lecanium deltae* Liz,. which was considered a serious citrus pest but lately its infestation has diminished considerably. During the last growing season, delta scale again caused damage in limited areas but continued to be of little importance in most places.

The renewed prevalence of the clover mite, *Bryobia prætiosa* Koch, appears to be related to the indiscriminate use of DDT and certain phosphorous insecticides. This mite causes considerable injury to peach trees, consequently reducing fruit production. Another pest which is increasingly hazardous is a leaf-rolling caterpillar, *Eulia sphaleropa* Meyr.

Among the major fruit pests are oriental fruit moth, *Grapholitha molesta* (Busck), and codling moth, *Carpocapsa pomonella* (L.), the former being more numerous than the latter on the Delta. Both species occur from October until

May, and can cause losses of 30 to 50 percent on apples. However, they are well controlled with the aid of a forecasting service which was established in 1953. The forecasting is based on investigations carried out by the former Laboratorio de Fitopatología del Delta, now integrated with the Estación Experimental Agropecuaria del Delta. There are normally five to six warnings. For the first two treatments lead arsenate, at a rate of 350 grams per 100 liters of water, is recommended in order to also simultaneously control the basket worm, *Oiketicus kirbyi* Guild. For the subsequent three or four treatments a 0.125 percent DDT spray is suggested for its greater effectiveness against the oriental fruit moth. As a result, losses to apples have been reduced to 1 to 2 percent. Peaches may partially escape the damage of the oriental fruit moth, as only early maturing varieties are grown on the Delta.

During a warm autumn, Mediterranean fruit fly, *Ceratitis capitata* (Wied.), is prevalent, causing serious injuries to grapefruits, oranges, and some early maturing mandarin varieties such as Satsuma. Apples are attacked from January to March but the insect is adequately controlled by observing the recommendations of the forecasting service. On peaches, the insect is found from December to February or March, and on citrus it appears in March and persists until the end of May or beginning of June, when the first frosts appear. Some growers use malathion with molasses as attractant for the control of the Mediterranean fruit fly, since protein hydrolizates are not readily available on the local market.

The West Indian fruit fly, *Anastrepha fraterculus* (Wied.), which is so important in other parts of the country, plays an insignificant role on the Delta.

Scale insects are well represented in the fauna of the islands. The San José scale, *Aspidiotus perniciosus* Comst., is most prevalent. It occurs mainly on apple trees but to a lesser extent on peach, prune and pear.

As regards citrus, the following scale insects are of importance: California red scale, *Aonidiella aurantii* (Mask.); the dictyospermum scale, *Chrysomphalus dictiospermi* (Morg.); purple scale, *Lepidosaphes beckii* (Newm.); snow scale, *Unaspis citri* (Comst.); the cottony cushion scale, *Icerya purchasi* Mask.; and the delta scale, *Lecanium deltæ* Liz., mentioned previously. The presence of these pests requires repeated treatment with mineral oils, with or without the addition of phosphorus insecticides.

The white peach scale, *Pseudaulacaspis pentagona* (Targ.), was first recorded on the Delta in 1908 and subsequently caused enormous losses. Through the introduction of the wasp, *Prospaltella berlesei* How., its population has been considerably reduced. As in other parts of the world, this parasite has become well established, so no rearing is necessary.

The citrus rust mite, *Phyllocoptruta oleivora* (Ashm.), occurs in isolated foci from November onward, causing serious damage in certain citrus plantations.

Dasyneura (*Perrisia*) *mali* Kieffer, a leaf-rolling larva, attacks the shoots of apple trees and hinders growth. This diptera undergoes four to five generations a year on the Delta and the earliest infestation occurs in mid- or end October.

The woolly apple aphid, *Eriosoma lanigerum* (Hausm.), weakens the trees, causing reduced yield and lower-quality fruit. This pest is partially controlled by the hemipterous parasite *Aphelius mali* (Hald.). In addition to the woolly apple aphid, the following aphids attack various fruit trees on the Delta: *Anuraphis amygdali* Buck., *A. persicæ-niger* (Smith), *A. helichrysi* (Kalt.), *Aphis pseudopomi* Blnchd., and *Paratoxoptera argentinensis* Blnchd.

The citrus bud mite, *Aceria sheldoni* (Ewing), is not widespread but occasionally malformed fruits may be found, characteristic of its attacks. *Hylesia nigricans* Berg., a South American native Saturniid, may cause severe or even complete defoliation of fruit as well as forest trees. Most affected are apple and prune trees, poplar (*Populus nigra*) and willow (*Salix alba* var. *calva*).

Pests of forest trees

There are some important pests affecting forest trees on the Delta, such as coleopterous borers, aphids and lepidopterous insects. The principal wood borer is *Platypus sulcatus* Chap.,

which attacks poplars with a stem diameter of over 20 centimeters. It causes considerable damage, as attacked trees have to be felled prematurely. The value of the timber is reduced by the bore holes and by the fungi which develop therein and blacken the wood.

Other insect pests of some concern are the giant willow aphid, *Tuberolachnus saligna* (Gmelin); the basket worm, *Oiketicus kirbyi* Guild; *Lina erythroptera* Blnchd., which attacks the leaves of willow; and the European pine shoot moth, *Rhyacionia buoliana* (Schiff.).

The leaf-cutting ant, *Acromyrmex lundi* Guer., is the most destructive pest of all crop plants on the Delta. It attacks fruit and forest trees, as well as horticultural crops, causing serious damage to young plants, especially those growing on higher land.

Nematodes *Meloidogyne* spp. have been observed on the roots of poplar and willow trees grown on soil composed of dredging silt. Their presence has also been reported on apple, prune and citrus trees, and on grapevines.

In plantations in which cultural methods, especially weeding and cleaning, are neglected, the red rat, *Holochilus vulpinus*, and guinea pigs, *Cavia* sp., cause mortality to trees.

Diseases of fruit trees

Apple and pear scab, caused by *Venturia inæqualis* (Cooke) Wint. and *V. pirina* Aderh. respectively, are responsible for severe losses almost every year because of favorable environmental conditions. Various fruit rots, such as bitter rot of apple, *Colletotrichum destructivum* O'Gara, black rot, *Sphæropsis malorum* Peck, and brown rot, *Sclerotinia fructicula* (Wint.) Rehm, are detrimental to susceptible apple varieties.

The apple varieties Jonathan, Rome Beauty and Glengyle Red are subject to attacks of powdery mildew, *Oidium farinosum* Cooke, particularly the first variety. Cultivation of these varieties has therefore been discontinued on the Delta. Occasionally a canker, caused by *Coniothecium chomatosporum* Corda, infects stems and branches, and apple canker, *Nectaria galligena* Bres., can be found on branches of debilitated trees but is of slight importance.

During the last ten years three diseases of prunes have become very severe and threaten to exterminate this crop if no adequate control methods are found. The most serious infection causes a subcortical necrosis of the branches and occurs mainly on trees derived from cuttings and root shots. It produces a wood necrosis and eventually kills the tree. This disease is still under investigation and its etiology seems to be a complex. Up to the present, only *Fusarium lateritium* Nees has been found to be associated with it but other agents are likely to be involved. Another disease, the symptoms of which consist of scalding of the border of the leaves, also causes much concern. It appears in December and becomes accentuated during the following months. The tree gradually loses vigor and withers within a few years. The disease is caused by a virus but no insect vector has been discovered. The third disease, the bacterial spot caused by *Xanthomonas pruni* Dows., may become serious on susceptible prune varieties such as Cristal, Ferrara and Wickson. It gives rise to cankers on the branches, and circular, dark violet, wet spots on the fruit. Small, circular, oily spots appear on the leaves which, when the affected tissues fall off, look like shot holes.

Although the Delta is a marginal zone for citrus growing, it offers good possibilities for small plantations. The main problem is that of frost, especially for lemon, which is the most widely grown citrus species. The diseases that affect this crop are easy to control.

Most citrus trees are grafted on trifoliata orange (*Poncirus trifoliata*) rootstock, because tristeza disease destroyed all orange and mandarin plantations established on sour orange (*Citrus aurantium*) stock. Trees on trifoliata orange are subject to exocortis infection, which produces bark scaling on the rootstock in five to nine years after grafting, resulting in gradual decay and stunting of the tree.

Gummosis, caused by *Phytophthora* sp., is most frequent and severe on lemon, and occurs only sporadically on other citrus species. Foot rots caused by fungi of the same genus are rare, as sweet orange is scarcely used as a rootstock.

Phomopsis citri Faw. is widespread and economically significant on the Delta. It attacks leaves, stems and fruits, and is most troublesome on lemons, which may be completely covered with black crusty spots. Of less importance is citrus scab, *Sphaceloma fawcetti* Bitancourt & Jenkins var. *viscosa* Jenkins, which attacks mainly mandarins and, to a lesser extent, oranges and lemons.

Quince is a characteristic fruit crop of the Delta. It is affected by a leaf spot due to *Entomosporium maculatum* Lév., which causes premature defoliation and may also attack fruits. The fungi which cause various fruit rots of apples may also affect quince.

Peach, which was the predominant fruit on the Delta, is no longer widely grown, partly due to the following diseases: brown rot, *Sclerotinia fructicola* (Wint.) Rehm; crown gall, *Agrobacterium tumefaciens* (Smith and Town.) Conn; leaf curl, *Taphrina deformans* (Berk.) Tul.; scab, *Cladosporium carpophilum* Thum.; powdery mildew, *Oidium leucoconium* Desm. var. *persicæ* Wor.; and other stem and fruit diseases caused by *Diaporthe eres* Wehm., *Coryneum carpophylum* (Lév.) Jauch and *Rhabdospora persiciphila* Speg.

Among all these diseases brown rot is the most significant, as it has constrained farmers to discontinue growing intermediate and late peach varieties. *Phytophthora cinnamoni* Rands., of minor importance on peach trees, causes a canker on the branches, especially on trees growing on periodically flooded land.

Diseases of forest trees

The most common disease of poplars is that caused by *Septoria musiva* Peck., which produces cankers on shoots and branches, distorting them and rendering them susceptible to windbreak. The same fungus produces necrotic spots on leaves and, in severe cases, induces premature leaf fall. Rust, *Melampsora* sp., causes heavy damage on susceptible varieties. Due to severe rust outbreaks in 1935 and 1936, the growing of *Populus nigra* forma *italica* was abandoned. A similar case occurred with regard to *P. deltoides* forma *carolinensis*, but this poplar is now planted again because of the resistance to rust it has shown in late years.

The most widely grown willow variety is *Salix alba* var. *calva*, the growth rate of which was very satisfactory until the incidence of anthracnosis, *Marssonina salicicola* (Bres.) Magn., increased, resulting in severe premature defoliation. For this reason there has lately been a tendency to replace it with resistant varieties. Two other species of willow, *S. babylonica* and *S. argentinensis* forma *hibrido*, are also subject to anthracnosis caused by *Marssonina kriegeriana* (Bres.) Magn. but the resultant injury is less important.

Less cultivated species such as plane trees, (*Platanus* sp.), *Casuarina* sp. and *Pinus insignis*, are attacked by *Phytophthora cinnamomi* Rands., which finds very favorable conditions for development on the Delta. This fungus causes canker on the stem.

Plant Protection in India

K. B. Lal, Directorate of Plant Protection, Quarantine and Storage, New Delh

Of the total area of about 320 million acres under cultivation in India, about 272 million acres are sown to cereals, maize, millets, pulses, gram and peas. The remaining acreage consists of sugar cane, cotton, jute, tobacco, groundnut, sesamum, rape and mustard, linseed, castor, arecanut, coconut, cashewnut, tea, coffee, rubber cacao, turmeric, chilli, ginger, cardamon, pepper and other spices, betel vine, cinchona and most of the fruits and vegetables commercially grown everywhere in the world.

The climate ranges from very hot to very cold, with annual rainfall varying from less than 10 inches in some places to over 100 in others. Crops are grown on plains (a few hundred feet above sea level) to altitudes of about 10,000 feet or higher. Although there are many large farms and plantations, owned by the government or private persons, holdings are mostly small, averaging not more than a few acres per family or even less. It is against such a background that the problems of plant protection in India need to be appreciated.

Pests and diseases

Over 250 insects and other animal pests, about 150 fungal, bacterial and virus diseases, about 30 weeds and four parasitic flowering plants damage crops, depress yields or deteriorate produce in India. Apart from insect pests, rodents, eelworms and mites cause severe damage, followed by elephants, monkeys, jackals, wild cattle, flying foxes, porcupines, several species of birds, crabs, snails, slugs and others. Among insects, some of the important pests are lepidopterous borers in paddy, sugar cane, maize, sorghum, gram, brinjal and tomato; coleopterous borers in cotton and fruit trees; *Agrotis* cutworms and various other caterpillar pests; *Hieroglyphus* and other grasshoppers; jassids on paddy and cotton; aphids on mustard, beans and cruciferous vegetables; pink and spiny bollworms of cotton; fruit flies and fruit-piercing moths; woolly aphids, San José scale; thrips on onion, grapevine and chilli; *Helopeltis* spp. on tea, not to speak of the well-known storage pests, termites and the desert locust. Among plant diseases, the destructive ones are the rusts of wheat, barley and linseed; bunt and smut of wheat; foot rot, seedling blight, leaf spot and ear blight and blast of paddy; wilt and blight of gram; smut, rust and red rot of sugar cane; wilt and black arm of cotton; late blight of potato, canker and wither-tip of citrus; bunchy top of banana; scab of apple; powdery mildew of mango; leaf blight of rubber; blister blight of tea; nut fall and bud rot of coconut and many others. Some very injurious weeds on arable land are *Pulchea lanceolata*, *Cyperus rotundus*, *Asphodelus tenuifolius*, *Chenopodium album*, *Convolvulus arvensis*, *Euphorbia* spp. and *Carthamus oxycantha*. Infestations by *Saccharum spontaneum* have rendered many lands unfit for cultivation. Water hyacinth has encroached upon enormous water areas, notably in northern and eastern India, and shows signs of spreading.

Introduction of plant protection

Although research on insect pests and plant diseases has been in progress in India since almost the beginning of the present century, no specialized organization existed for testing results on any large scale in the field and making information available to farmers. Even in cases where this had been done, no arrangement had prevailed whereby the farmers could be induced to adopt measures for pest and disease control or assisted in implementing them. The acute food shortage following in the wake of the Second World War, and the Bengal famine of 1942/43, a major cause of which was the failure of the rice crop due to the attack of the fungus *Helminthosporium oryzae*, focussed attention on the need to protect crops and crop produce against pests and diseases. The first step taken by the Government of India in this direction was to establish a central Directorate of Plant

Protection, Quarantine and Storage, in 1946, with headquarters at New Delhi. In brief, the functions of the Directorate, which is the national organization for plant protection in India, has been to promote plant protection activities throughout the country and to assist the state governments in developing organizations and programs for similar purposes.

Arrangements for plant protection

The responsibility for ensuring the effective and prompt adoption of pest and disease control measures, on as large a scale as possible, rests primarily with the governments of the 14 states and the administrations of the six Union territories which constitute the Republic of India. For this purpose, they have set up their own plant protection organizations and are assisted financially or otherwise by the Central Government. The assistance takes the form of financial subsidies, so as to enable the states and the Union territories to distribute pesticides and manually-operated plant protection equipment to farmers at 50 percent cost. However, only a fraction of the farmers' requirements is met on this basis, and they have to make their own purchases on the market for other needs. A second form of assistance is the provision of pesticides at cost price and plant protection machines on loan at prescribed rates to state governments and farmers through a chain of 14 regional plant protection stations. These stations are widely scattered over the country and operate under the Directorate of Plant Protection, Quarantine and Storage. A third form of assistance is the provision of aeroplanes from a central unit for aerial spraying and dusting of crops in any part of India at a uniform rate of charge. Thus, the costs per acre are the same no matter where the aeroplanes operate. Some other forms of assistance include the *ad hoc* provision of technical personnel for plant pest and disease surveys, regional training programs for plant protection personnel, technical advice, etc.

A few of the state plant protection organizations have also functioned as service organizations, spraying and dusting the farmers' crops at scheduled rates. However, the farmers have in general been expected to adopt such measures themselves, with technical and other assistance obtained from the government. Contract spraying and dusting of crops by commercial firms has not been commonly adopted in India so far, except in limited cases relating specifically to weed control.

Research on plant pests and diseases

Since research must provide results for application in the field, the state governments maintain their own organizations for research on pests and plant diseases. In this task they are assisted by the Indian Council of Agricultural Research, which finances, in part or in full, specific projects. The Government of India has established Central Commodity Committees for sugar cane, cotton, jute, oilseeds, tobacco, coconut and arecanut, which financially assist in projects of research and extension, including plant protection, pertaining to the crops with which they are concerned. The Government of India or the Commodity Committees also maintain several institutes for research on fundamental or regional aspects of agriculture. For example, the Indian Agricultural Research Institute in New Delhi is general in scope, and there are specific institutes for rice at Cuttack, potato at Simla, sugar cane at Coimbatore and Lucknow, tobacco at Rajamundary, cotton at Indore, jute at Barrackpore and coconut at Kayangulam. State governments have established various research stations for fruits and vegetables. There is also the Tea Research Station at Tocklai (Assam), maintained by tea planters, and the Indian Coffee Board maintains a research department at Balehonnur in south India. All of these institutions have entomologists and plant pathologists on their staff to meet the requirements of plant protection.

Use of pesticides

During the past ten years, the most popular method of pest and plant disease control in India, as elsewhere, has been the use of pesticidal chemicals. The insecticides commonly used have been BHC, DDT, endrin, aldrin, dieldrin, lin-

dane, heptachlor, parathion, malathion and some others. Among fungicides, organo-mercuric compounds and sulphur have been employed for seed treatment against seed borne diseases of wheat, barley, oats, maize, paddy, millets and cotton. Bordeaux mixture, other copper fungicides and sulphur have been used to dust or spray crops. Efforts have been made to control some weeds by spraying 2,4-D or MCPA. Zinc phosphide has been widely used in poison baits against field rats and jackals, though warfarin and tomorin have also been tried. Pest-infested grain stocks and godowns have been fumigated with ethylene dichloride-carbon tetrachloride mixture, though in many cases methyl bromide has also been employed. Rat burrows have been fumigated with calcium cyanide. Application equipment has ranged from small, manually-operated spraying, dusting and seed-dressing machines to power-operated machines, including low-volume sprayers and aeroplanes.

Biological control

Biological control has been tried in India since about 1920, if not earlier. The first success achieved was against prickly pear (*Opuntia* spp.), in south India, by the use of the caterpillar, *Cactoblastis cactorum* Berg, and the mealy bug, *Dactylopius ceylonicus* Green. Attempts have since been made to control the coconut caterpillar, *Nephantis serinopa* Meyr., in south India by the Bethylid *Perisierola nephantidis* Meus., and the Eulophid *Trichospilus pupivora* Ferr.; cottony cushion scale of citrus in south India by the ladybird predator, *Rodolia cardinalis* Muls., imported from Australia; woolly aphids in the Punjab and Uttar Pradesh by the Chalcid, *Aphelinus mali* Hald.; and some sugar cane lepidopterous borers throughout India by *Trichogramma evanescens minutun* Riley. While the control of the cottony cushion scale has been completely achieved, efforts to eradicate coconut caterpillar are still being continued. Although the Punjab has claimed success in the use of *A. mali*, Uttar Pradesh has not. The general opinion about *Trichogramma* has been that it has failed to effectively control sugar cane borers in most, if not all, parts of India. Further work is being done in the control of sugar cane borers and San José scale of apple by importing suitable parasites through the Biological Control Station, established by the Commonwealth Institute of Biological Control at Bangalore in 1956, as a result of an agreement under the Colombo Plan, between the Governments of India and Canada.

Cultural control

Attempts to evolve crop varieties resistant to pests and diseases have continued for over the past 40 years. However, the present situation suggests that there is not a single pest problem in India which has been successfully eliminated by the use of reseistant varieties. In the case of plant diseases, some success has been achieved in the control of wheat rusts and cotton and gram wilts. The difficulty with the resistant varieties has been that they have had to be evolved for specific crops, areas, pests and diseases, that the resistance has not been stable for any long period, and that new strains of pests and diseases have appeared and have virulently attacked even the resistant varieties. It has appeared to the writer, therefore, that the role of resistant varieties in plant protection has been extremely limited, at least where India is concerned.

Mechanical control

Mechanical measures of control commonly practiced include the removal of weeds by means of hand implements, roguing of disease-affected plants, collection of eggmasses of some pests of sugar cane, use of light traps, catching of rats and wild cattle by means of traps, scaring away of birds and monkeys by constant day-long vigil, driving away hordes of advancing, wild elephants by throwing over them burning rags tied to small sticks, soaking of wheat seed in water and drying in hot sun against loose smut caused by *Ustilago tritici*, and the collection and burning or burying of cotton buds and bolls fallen on the ground, to check pink boll worm infestation. Some mechanical measures, such as the destruction of locust hoppers by driving and burying them in specially prepared trenches, and the use of light traps for other insects are fast disappearing. Some others,

for example, the catching of wild cattle and the driving away of elephants, are not likely to be replaced by other measures.

Locust control

Of the three locust species known to occur in the Indian region, the desert locust, *Schistocerca gregaria* Forsk., is by far the most destructive. The Rajasthan desert forms the easternmost limit of its distribution. Authentic records of desert locust plagues in India (and also Pakistan) have been available since 1863. Though solitary breeding occurs exclusively, and gregarious breeding mainly, in the desert areas of Rajasthan, Bombay and the Punjab States, swarms have travelled as far east as Assam and as far south as Mysore State.

The Government of India has assumed direct responsibility for locust control in the desert areas but in others the responsibility is of the state governments concerned. The provision of over-all guidance, co-ordination and assistance, is still a function of the Central Government. A Locust Warning Organization was established on a permanent basis in 1939 and has been functioning since 1947 from three main bases at Jodhpur, Bikaner and Palanpur, with a network of locust outposts. The number of outposts has varied from about 29 to 90 in different years, depending on the locust situation. The Organization has been concerned with regular locust surveys, intelligence and control. Although elaborate research on the desert locust in the laboratory and in the field had been conducted from 1931 to 1947, the realization of the need for research on a continuing basis led the Government of India to establish a Field Station for Investigation on Locusts at Bikaner in 1957.

The main method of locust control in India has been that of dusting with 5 to 10 percent BHC, though aldrin, dieldrin, lindane, acrodel, and heptachlor have also been tried and used. Poison baiting with sodium fluosilicate, for example, which had been practiced in the thirties, has been completely disregarded, even though newer chemicals have been available for use in baits. Aircraft has been successfully employed in locust control since 1951 and against other pests since 1955. Locust control in India is now mostly mechanized. The Government of India has also actively collaborated in international efforts for desert locust control.

Plant quarantine

The Destructive Insects and Pests Act of 1914, and the various notifications issued thereunder from time to time, empower the Central Government to enforce plant quarantine measures in respect of plants and plant materials imported into India. For this purpose, plant quarantine stations have been set up at the seaports of Bombay, Cochin, Madras, Visakhapatnam and Calcutta, and at the airports of Amritsar, New Delhi, Bombay, Madras and Calcutta. Some further expansion of plant quarantine facilities is being considered. India is a party to the International Plant Protection Convention of 1951 and the Plant Protection Agreement for the South East Asia and Pacific Region of 1956, both sponsored by FAO. In respect of plants and plant commodities intended for export, the Government of India is prepared to inspect, fumigate or otherwise suitably treat consignments and issue official phytosanitary certificates, should the governments of the importing countries so require.

Plant protection legislation

Several of the state governments have acquired legislative powers to compel farmers to adopt prescribed measures of plant pest and disease control whenever specified areas are officially declared as affected by specific pests or diseases liable to damage individual crops. Failure on the part of farmers to adopt the required measures may involve penalties of fine and simple imprisonment, and can lead state governments to have the measures adopted by their own agencies, at the farmers' expense. Usually the power is exercised only if the required measures of pest or disease control are indicated precisely, if means for their adoption are easily available to farmers, and publicity and propaganda adequately precede notice of compulsion. Legislation also exists in some states to compel all able-bodied adults to assist in locust control.

Plant Quarantine Announcements

JAMAICA

Customs (Importation) (Prohibition) (Fruit, Plants and Vegetables) (Amendment) Proclamation, 1959, published in the *Jamaica Gazette* dated 3 July 1959, provides that phytosanitary certificates accompanying consignment of seed potatoes, table potatoes, plants and plant parts imported from any country must state, in addition to other requirements, that they were produced in an area which is free from golden nematode (*Heterodera rostochiensis*).

Customs (Importation) (Prohibition) (Fruit, Plants and Vegetables) Proclamation, 1949, requires that a shipment of potatoes must be accompanied by a certificate affirming that potatoes are not infected by potato wart (*Synchytrium endobioticum*) and that this disease does not occur within five miles of their place of origin; and that the potatoes are not infected by bacterial ring rot (*Corynebacterium sepedonicum*).

MEXICO

Resolution of 2 July 1959, issued by the Ministry of Agriculture and Livestock and published in the *Diario Oficial* Vol. 235, No. 15, on 17 July 1959, amends Exterior Quarantine No. 6 of 17 July 1927. By this amendment, hoja blanca of rice is added to the list of plant diseases, the introduction of which is to be prevented.

Exterior Quarantine No. 6 provides that the importation of rice seed or paddy rice is permitted only from the United States, subject to the requirements applicable to partial exterior quarantines. The list of prohibited plant diseases is a follows:

Flag smut of wheat (*Urocystis tritici*)
Take-all or foot-rot (*Ophiobolus graminis*)
Downy mildew (*Sclerospora macrospora*)
Leaf smut (*Entyloma oryzae*)
Blight (*Oospora oryzetorum*)
Glume blight (*Phoma glumarum*)
Hoja blanca virus

PERU

Supreme Resolution No. 68 of 11 April 1959, published in *El Peruano* on 27 April 1959, establishes regulations for the importation of plants, seeds, cuttings, bulbs, rhizomes and other plant products whose importation is subject to current plant quarantine legislation.

An importer of the above-mentioned materials must submit a request to the Ministry of Agriculture, indicating the species and quantity to be imported, place of origin, port of shipment, and route of shipment. The plant materials must be accompanied by an official phytosanitary certificate of the country of origin, legalized by the Peruvian Consul, stating that the materials have been found to be free from harmful plant pests and diseases. At an authorized point of entry the goods will be inspected by officers authorized to disinfect or destroy them, whenever the requirements are not met and in case of seeds, to send them back to the country of origin.

In special cases concerning the importation of specific seeds, a certificate stating that certain pests and diseases do not occur at the place of origin will be required.

Seed potatoes, cotton, coffee, rice, and any other plant material or plant product, the importation of which is governed by specific regulations, will continue to be subject to the said regulations.

UNITED KINGDOM

The Importation of Raw Vegetables Order 1959 for England and Wales came into operation on 1 March 1959. It modifies, for specified periods of the year 1959, the restrictions imposed by the Importation of Plants Order 1955 (see *FAO Plant Prot. Bull.* 3 : 60-62. 1955) on the importation of certain raw vegetables from specified districts of Belgium, France, Italy and the Netherlands. The provisions are similar to those governing the importation

of raw vegetables in the Importation of New Potatoes and Raw Vegetables Order 1958 for England and Wales (see *FAO Plant Prot. Bull.* 6 :109. 1958).

The Importation of Raw Vegetables (Scotland) Order 1959, and the Importation of Raw Vegetables (Northern Ireland) Order 1959 contain similar provisions.

UNITED STATES

Administrativei nstructions prescribing methods of treatment of garlic (*Allium sativa*) from Algeria, Hungary, Italy, Morocco, Spain and Yugoslavia (see *FAO Plant Prot. Bull.* 2 : 143. 1954) were further amended by a Foreign Quarantine Notice published in the *Federal Register*, Vol. 24, No. 80 of 24 April 1959. This amendment modifies the methyl bromide fumigation schedule for garlic imported from the above-mentioned countries through approved ports of entry. The revised schedule under a 15-inch vacuum is as follows:

Temperature, °F.	Dosage, in lb., of methyl bromide, per 1,000 cu. ft.	Exposure period, in hours
90-96	2	1½
80-89	2	2
70-79	2½	2
60-69	3	2
50-59	3	3
40-49	3	4

The alternative requirements for the importation of garlic from Italy and Spain under permit remain unchanged (see *FAO Plant Prot. Bull.* 3 : 62. 1955).

News and Notes

CO-OPERATION IN WEED CONTROL RESEARCH IN EUROPE

On the occasion of the Tenth International Symposium on Phytopharmacy, held at Gent, Belgium, on 6 May 1958, a meeting was arranged to consider means for achieving closer international co-operation in weed control research. To this end, it was agreed to form an informal International Research Group on Weed Control, and Prof. Dr. E. Rademacher of Western Germany was elected president.

The first technical conference of this group which was patronized by the European Productivity Agency, took place on 3-4 March 1959 at Stuttgart-Hohenheim, Germany, and was attended by 50 research workers in the field of weed control, representing 14 European countries. In a review of the progress on weed control research in different countries, summaries on work carried out in each country relating to weed control in vegetable crops, forests and forest nurseries, control of wild oats, and the relation between herbicides and soils were presented and discussed. A decision was reached to establish several working parties.

One of the working parties is concerned with the study and control of bracken fern (*Pteridium aquilinum*), and Dr. E. Röhrig of the *Institut für Waldbau at Hannoversch-Münden* is the liaison for this subject. A review of the research on weed control in forest nurseries will be prepared with Mr. H. Faber of Rellingen as contact. Exchange of information on study and control of wild oats will be facilitated by another working party, for which Mr. H. Ingv. Petersen of Sknovlunde, Denmark, will be responsible. In this connection, Miss J. M. Thurston of the Rothamsted Experimental Station will study the characteristics of seed specimens from different countries. Methods for weed control research will be the subject of still another group, with Dr. H. Johannes of Braunschweig as contact.

A list of literature on the biology of weed species will be prepared by Mr. P. Zonderwijk of Wageningen, in co-operation with research workers in other countries. Other working parties planned will concern aquatic weeds and their control, alpine weed problems, and the relation between herbicides and soils.

At the business session of the conference, it was decided to consider the formation of a more permanent professional research organization. An interim council was elected, consisting of the following members: Dr. E. K. Woodford (President), Great Britain; Dr. W. van der Zweep (General Secretary), the Netherlands; Prof. Dr. B. Rademacher, Germany; Dr. E. Åberg, Sweden; Dr. J. J. Stryckers, Belgium; and Dr. R. Longchamp, France. Plans developed by the interim council will be discussed at the next conference, to be held at Oxford on 5-6 April 1960, when a symposium will also be held on specific aspects of weed control research.

FAO GRAIN STORAGE NEWSLETTER

As an aid to its expanding activities in grain storage, FAO has initiated a mimeographed series entitled "Grain Storage Newsletter," which is to be issued quarterly for the dissemination of information in the field of grain storage, with special reference to the reduction and prevention of losses. The major topics covered will include existing facilities for research and training in various countries, descriptions of research projects in progress, new techniques developed to reduce losses and to prevent spread of storage pests, and current or prospective events of international interest in this field. A section of the newsletter is to contain abstracts and reviews of selected current literature on grain storage. The first issue appeared in June 1959.

Enquiries about the newsletter should be addressed to the Crop Protection Branch, Plant Production and Protection Division, FAO, Viale delle Terme di Caracalla, Rome, Italy.

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